Capital Mobility and the (In)efficiency of Fiscal Unions

by

Roberto Perotti, Columbia University

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Roberto Perotti

Columbia University

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Several countries in all parts of the world are undergoing a process of integration, several others are experiencing strong pressures towards increasing decentralization. At the same time, many of these countries are struggling to control the expansion of redistributive expenditures and their distortionary effects on the allocation of resources. Therefore, a fundamental question in all these countries is what is the allocation of tasks to different levels of governments that best controls social expenditure and minimizes distortions. Because these processes occur within or between economies with high capital mobility, a second crucial question is therefore what are the effects of capital mobility on the budget size and productive efficiency under different fiscal policy arrangements.

This paper develops a two-country model where redistribution is determined endogenously through a voting process, and argues that a decentralized regime is likely to minimize the distortionary effects of redistribution. Surprisingly, capital mobility exacerbates the inefficiency of the centralized regime. First, capital mobility increases the distortionary effects of redistribution in the economy; second, once the choice of the regime too is endogenized, it causes a majority of individuals in *both* countries to choose the more inefficient regime.

The paper also highlights the importance of considering specific institutional aspects of redistribution, the tax system and labor markets. An important message of the model is that a process of fiscal integration may lead to "bad" outcomes when it involves countries with very different institutional characteristics.

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1 Introduction.

In virtually all industrialized countries, the two crucial macroeconomic problems of fiscal policy are the explosive expansion of social programs, both in absolute terms and in relation to other types of government expenditure (see Table 1), and their perceived distortionary effects on the allocation of factors (see the recent OECD *Job Study* (1994)).

Table 1: **Govt. consumption and social expenditure in Europe, 1960 and 1988.**

	1960	1988
Govt. cons.	12.80	18.89
Soc. exp.	10.15	25.61

All figures are in shares of GDP. Sources: EUROSTAT (social expenditure) and OECD (government consumption). Countries included in the sample: Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, UK. Social expenditure includes the following types of benefits: sickness; invalidity/disability; employment injury; old age; survivors; maternity; family; unemployment; vocational training; housing.

A fundamental question in all these countries is therefore what is the allocation of tasks to different levels of governments that best achieves control over social expenditure and minimizes distortions. This question clearly need to be analysed in the context of highly integrated economies, where high capital mobility potentially limits the scope for independent fiscal policies in smaller units. A second crucial question in these processes of fiscal integration and decentralization is therefore what are the effects of capital mobility on the budget size and productive efficiency under different fiscal policy arrangements. This paper studies these two questions in the context of a positive model where fiscal policy is determined by aggregating the preferences of diverse, self-interested individuals.

The public finance tradition has focused mainly on the study of the social optimality

of different degrees of decentralization of the financing and provision of public goods. In general, the conclusion is that decentralized arrangements induce a suboptimal provision of public goods because lower levels of governments fail to internalize the effects of the public goods they provide and because of taxpayers mobility. As shown in Table 1, however, the focus on the provision of public goods does not seem justified any more, as redistribution takes up the largest share of the government budget virtually everywhere in the industrialized world.

Even when it has dealt specifically with redistribution, the public finance tradition in fiscal federalism has approached the problem as one of public goods with different spatial coverage. [1] Redistribution has a public good dimension because taxpayers care about the welfare of low-income individuals. As argued first by Stogler (1957), if the financing of redistribution is decentralized, a standard free-rider problem implies that there will be too little redistribution in a voting equilibrium. This conclusion holds even when taxpayers care only about the welfare of the poor geographically close to them, as in Pauli (1973) and Brown and Oates (1987), provided the poor and/or the taxpayers are mobile. The reason is that ecah sub-central government will try to export the costs of redistribution by setting lower taxes and transfers than its neighboring sub-central governments, thereby inducing outmigration of the poor and immigration of the rich. More generally, the existence of all sorts of spillover effects implies that both the financing and the provision of redistribution is best carried out at the central level. [2] Thus, with few exceptions, the dominant view in this tradition is clearly in favor of a system of centralized redistribution. [3]

The public finance tradition provides an important theoretical benchmark for the analysis of fiscal policy in multi-layered governments. To answer the two macroeconomic questions posed at the beginning, however, it is necessary to incorporate some fundamental realistic features of social expenditure programs in the analysis. This requires a departure from the traditional framework in at least three directions.

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[1]The title of the seminal application by Orr (1976) best exemplifies this approach.

[2]See Oates (1972) for a useful exposition of the main arguments for and against centralization, and Inman and Rubinfeld (1992) for a brief survey of more recent issues.

[3]Johnson (1988) and (1990) provides such an exception. Because redistribution decreases the local per capita income via its effects on labor supply, it also decreases the amount of federal taxes paid by local residents. It might then be less costly to local residents to finance redistribution at the local level *if* the other localities do not follow the same strategy, because the net transfers from the federal government increase. As a consequence, local financing might lead to more, rather than less, redistribution. However, the difference between the two systems disappears in a symmetric Nash equilibrium where all localities try to decrease their federal taxes by increasing local redistribution, because in this case the net federal transfers remain zero. Finally, if labor is sufficiently mobile across localities, the usual problem of underprovision of redistribution caused by the outmigration of the rich and the immigration of the poor will arise.

First, one must model explicitly the diverging interests behind redistributive fiscal policy. In the traditional public finance approach, redistribution is the result of an altruistic motive. Yet, it is hard to believe that the existing problems with social programs have been caused by an excess of altruism on the part of the average taxpayer. In this paper, I endogenize fiscal policy by studying a majority voting process among groups with constrasting interests regarding expenditure and taxation. This assumption is obviously only a crude approximation to the actual determination of fiscal policy in the real world. Other ways to endogenize fiscal policy, such as pressure groups or bargaining, could also be considered. [4]

Second, there must be room for the distortionary effects of redistribution on the allocation of resources. In particular, one must recognize that redistributive programs interact extensively with the functioning of labor markets. On one hand, it is the structure of labor markets that determines how many recipients there will be for a given program: for instance, once the government has set the level of the benefit, it is the labor market that determines how many workers will apply for an unemployment benefit, and therefore the final expenditure on that program. On the other hand, these programs have important effects on the working of labor markets: an unemployment benefit program obviously distorts the allocation of resources both because it subsidizes unemployment, and because of the distortionary taxes needed to finance it.

Third, rather than treating social programs as just different types of public goods, one must consider the specific administrative elements that characterize these programs. Two elements are particularly important: (*i*) social programs are open-ended: the government fixes the eligibility criteria and the amounts of the benefits, but the total expenditure is determined by the response of the economy; (*ii*) even when they are funded at the central level, their administration is necessarily sub-central. This gives sub-central governments (or sub-central branches of the agency that administers the program) considerable discretion in determining the number of beneficiaries and, ultimately, the total expenditure on a certain program. For instance, a sub-central government may be more or less generous in setting that part of the benefit level that is left to its autonomy; more or less rigorous in applying eligibility criteria; more or less elastic in assessing the disability and sickness claims; and more or less supportive of the claimant's position in appeal decisions.

The next section discusses extensively the empirical relevance and quantitative importance of the three characteristics of social expenditure underlined so far: their clienteles, their interactions with the working of labor markets, and especially their specific

[4] Epple and Romer (1991) also emphasize the importance of endogenizing redistributive decisions in subnational fiscal policy by explicitly considering a voting process.

administrative characteristics. Here, I develop a first intuition of how they provide a framework for the analysis of the two macroeconomic questions posed at the beginning, namely the efficiency of alternative degrees of decentralization of the financing of redistribution and the role of capital mobility.

In all the discussion so far, a sub-central level could be interpreted as a region within a country or as a country within a federation or union. Accordingly, the central level would be the country under the first interpretation and the union under the second. As documeneted in the next section, differences in collective attitudes towards redistribution and in administrative standard can be large among states within the U.S. and even between counties within individual states. *A fortiori*, then, one would expect these differences to be large and important between countries joining a union. In fact, different national preferences towards social security[5] are at the forefront of the policy debate on European integration. [6] To the extent that these administrative and political differences reflect differences in political systems and institutions, they cannot realistically be eliminated in the short or medium run; therefore, they will be reflected in the administration of social security within a fiscal union. Hence, from now on I will cast the discussion in terms of countries within a union.

The answer the model provides to the first question - namely, what allocation of responsibilities best controls the size of the budget and minimizes distortions - is that decentralized financing minimizes distortions because it limits the fiscal resources available to subsidize voluntary unemployment. The answer to the second question - what is the role of capital mobility - is that, contrary to a common argument, capital mobility does not provide a cure to the distortions inherent in centralized redistribution, rather, it exacerbates them.

The main intuition for these results is as follows. A centralized fiscal policy might allow a country in a federation with a more generous attitude towards redistribution to draw tax revenues from other countries with more rigorous standards. This might provide the first country with the resources for an expansion of its redistributive programs, with all their distortionary effects. By contrast, in a decentralized fiscal system each country has to rely on its own tax revenues to finance the resulting unemployment. Thus, little or no unemployment will be subsidized in equilibrium and little or no

[5] In what follows, the expression "social security" refers to all programs that redistribute income across individuals with different incomes. In particular, it also includes welfare programs (see the legend of Table 1 for a list of the programs included in the definition).

[6] For instance, according to the polls, concerns on the destiny of the national social security systems in an integrated Europe were a major source of strength for the forces opposing European Union membership in Denmark, Norway and Sweden, and were the single most important cause of the rejection of the membership in the first Danish referendum.

distortions will result.

Furthermore, capital mobility exacerbates the inefficiency of the centralized regime. When capital is mobile, if voters in one country raise the tax rate to subsidize unemployment, they cause an outflow of capital both because employment decreases and because taxation of capital increases relative to the other country. In a centralized system where the tax rate is by definition the same in both countries only the first effect is present, so that the marginal cost of increasing taxes is always lower in this regime. In fact, a first important result of this paper is that in a centralized regime unemployment is higher when capital is mobile.

Given the inefficiency of the centralized regime in the presence of differences in administrative standards between countries, one would think that a majority of voters in at least one country (the one that is losing tax revenues on net) would refuse to be part of this arrangement. However, when capital is mobile, a majority of agents in *both* countries will be in favor of a centralized regime. Even in the country that is losing tax revenues, a majority of agents are actually better off in the centralized regime, essentially because their country is receiving the capital that is flowing out of the distorted economy. Hence, and contrary to a plausible intuitive argument, capital mobility has a perverse effect here: it exacerbates the inefficiencies of the centralized regime, *and* it causes a majority of voters in *both* countries to accept the more inefficient regime.

Thus, an explicit consideration of more realistic features of social programs, of their political process and of the economic environment leads one to question the widespread preference for centralized redistribution coupled with capital mobility. A more general conclusion of this paper (which it shares with other recent contributions, like Alesina and Perotti (1994) and Alesina and Spolaore (1994)) is that, when countries have large institutional and/or political differences, they might be better off going their own ways rather than integrating.

The plan of the paper is as follows. Section 2 discusses more in detail the specific elements of social expenditure emphasized in the introduction. Section 3 presents the model and discusses its assumptions. Sections 4 and 5 solve the model for the cases of immobile and mobile capital, respectively. Section 6 endogenizes the choice of the fiscal regime. Section 7 concludes by discussing some possible extensions of the model and its relationship with some recent literature.

2 Administration and politics in social programs.

Before addressing the formal analysis, it is important to understand the empirical relevance of the characteristics of social programs that were highlighted in the previous

section, in particular: (*i*) social programs are open-ended and (*ii*) their administration is necessarily decentralized. To do so, it is useful to consider first the U.S. case.

These characteristics are certainly of major importance in those programs, like AFDC and Food Stamps, that are funded at least in part at the federal level but are largely administered by the states, including the setting of eligibility criteria. In 1970, during the hearings on the reform for AFDC, Repr. John W. Byrnes told the Rules Committee: "The present system is completely open ended.. The Congress and the Federal Government are at the mercy of the States." (quoted in Derthick (1990), p. 88). Furthermore, because the administration of these programs is essentially local, even within individual states different administrative efforts among counties imply large inter-county differences in total expenditure per capita. Stine (1988) has documented large differences in the annual welfare administrative expenditure per AFDC case among 57 counties in New York state. In 1980, the range was $91.67 to $549.62. Moreover, administrative effort is highly correlated with a measure of redistributive effort, the percentage of families below the poverty line that receive AFDC benefits. In 1980, this percentage ranged for 22.3% to 96.0% in the 57 counties of the study.

The disability pension program is a second example. This program is less decentralized than the Food Stamps and AFDC programs: although the actual administration of the program is obviously local, now the standards and eligibility criteria are set by the Social Security Administration and are valid for all the states. Yet, its recent history provides a very clear illustration of the factors that are emphasized in tis paper. During the 70's, the growth of expenditure in the social security disability program was double that of receipts; in 1977, this situation resulted in a "funding crisis" that prompted the Social Security Administration to call for a tightening of the eligibility and adjudication criteria by the state bureaucracies. As documented by Parsons (1991), under political pressure from the federal goverment initially most states responded positively: this was reflected in a drastic increase in the denial rate for disability applications, from 55% in 1977 to 68% in 1980. However, as several states refused to cooperate because of internal political pressure, this increase in the *average* denial rate was accompanied by an impressive increase in the inter-state variance in denial rates: for instance, in New York state it rose from 47.3% in 1977 to 72.3% in 1978, while in Colorado, Virginia and a few other states it actually fell over the same period. Moreover, the average increase in the denial rate was accompanied by a fall in the *application* rates: Parsons estimates that a percentage increase in the former leads, after two years, to a fall in the latter by .4%. As a consequence of these administrative interventions, the 1977 funding crisis was averted. Thus, this episode illustrates vividly a series of features of social programs that tend to be overlooked in most macroeconomic analyses: (*i*) the role of political factors; (*ii*) the

importance of the administration of the programs in determining their sizes; (*iii*) the independent role of sub-central governments and administrative agencies; (*iv*) the high variance in the responses of sub-central governments and administrative agencies.

The brief discussion of the U.S. case suggests that these features are relevant for all those social programs whose membership implies some element of discretionality on the part of the administration and/or some scope for abuse on the part of applicants: in practice, all social expenditure programs except old-age pensions. Of course, the actual relevance of these issues will vary, depending on the extent of political involvement in the managing of social expenditure, of bureacratic inefficiency, or downright corruption. But the crucial point is that these issues are of major macroeconomic significance, because they apply to the majority of social programs, which in turn constitute the main single item of practically all government budgets in contemporary inustrialized countries. For instance, in some countries, like Italy, Netherlands and Portugal, expenditure on disability pensions alone is comparable to (and in the case of Italy until a few years ago, higher than) expenditure on old-age pensions.

There can be several patterns and motivations for the different attitudes of sub-central governments concerning social expenditure policies. In some cases a generous administration of a social security program is simply a way to build consensus around sub-central governments. For instance, in Italy the average ratio of invalidity and disability pensions to old-age pensions in the whole country in 1991 was 91.2%; however, the same ratio was 47.6% in the North, 210.7% in the South and 301.4% in the region of Sardinia. [7] Clearly, these differences have nothing to do with demographics; rather, this pattern is the result of the working of political patronage at the local level, especially in depressed areas. For instance, the appeal decisions for disability claims in Italy are examined by local committees, whose membership is mainly composed of representatives of labor unions and other professional organizations, all of them appointed by and linked to the local government. Perhaps not surprisingly, the great majority of disability pensions have been awarded after one or more appeals (see Ferrero (1984)).

In other cases, the expansion of certain programs at the local level might reflect cyclical or structural conditions in the labor market. In the study cited above, Stine found that administrative effort in a county increases when the county's unemployment rate increases. The high incidence of disability pensions in Holland (50% of old age pensions in 1990) is the result of an intentional relaxation of eligibility criteria to support long-term unemployment, tolerated and even encouraged by the central government (see Haan, Sterks and de Kam (1993) and Emerson (1988)). These features are often even

[7] According to Yates (1986), the same ratio was 669% in the Enna province in Sicily in 1977!

institutionalized: during the 80's, in Holland and Italy the local labor market conditions were recognized by the law as legitimate determinants in assessing eligibility for disability benefits.

In other cases still, the expansion of social expenditure at the local level may be the result of simple collusion or downright corruption. In less extreme situations, differences between localities might simply reflect different preferences of local governments.

The main implication of all these cases is that it is of fundamental importance to distinguish between the *administration* of social programs, that for technical reasons is necessarily decentralized, and the *funding* of redistributive programs, which for historical reasons tends to be centralized, but *need not be so.*

3 The model.

A. Assumptions.

1. Technology and factor endowments. There are two countries, A and B. Each country produces a single good with a Cobb-Douglas technology using labor, L, and capital, K: $y = L^{\alpha}K^{1-\alpha}$. [8] In each country there are three classes of agents: a total mass $\bar{L}$ of workers, each endowed with one indivisible unit of labor; a total mass $\bar{L}_K$ of holders of capital ("capitalists" hereafter), each endowed with $\bar{K}/\bar{L}_K$ units of capital; and a total mass $\bar{L}_R$ of unproductive agents. The only source of income of this last class is therefore fiscal redistribution. One can think of members of this class as retirees, in which case their income would be an old-age pension. Alternatively, one could assume that there are $\bar{L} + \bar{L}_R$ individuals with labor endowment, who face an idiosyncratic risk of losing their endowment with probability $\bar{L}_R/(\bar{L}_R + \bar{L})$; in this case, the income of an individual hit by a negative shock would be a disability pension. The common feature to these interpretations is that these agents' only interest is in maximizing redistribution. Only for brevity's sake I will refer to this class as "retirees".

These three classes represent in a compact way the spectrum of interests in the fiscal system: capitalists earn factor income and always dislike taxes, workers earn factor income and support taxes under some circumstances, and retirees have no factor income and support as much taxation and redistribution as possible. To avoid trivial voting equilibria, I assume that each of the three classes of agents has by itself less than 50%

[8] Because the number of factors exceeds the number of goods, the factor price equalization theorem does not hold. However, since the two countries have identical technologies and factor endowments, the wage and the return to capital would be equalized if the structures of the labor markets were the same.

of the total votes.

2. Fiscal policy. Fiscal policy consists of a redistributive program that provides a pension s to retirees and is financed by a proportional tax rate on capital income. The size of s is endogenous, and determined by majority voting as specified below. The budget is always balanced. To insure an internal solution to the voters' problem, I assume that there are convex costs of redistributing taxes, so that when the tax rate is t and the tax base is X, a fraction t of total tax revenues is wasted, and only the amount $(t - t^2)X$ can be redistributed. Effectively, this assumption imposes an upper bound on the tax rate that will be enacted in equilibrium, because for a given tax base tax revenues are maximized at $t = \frac{1}{2}$.

Fiscal policy can be decentralized or centralized. In the first case each country chooses its own tax rate by majority voting, and all redistribution is financed using the revenues raised in that country only. In the second case a common tax rate is chosen by majority voting by all the citizens of the two countries, and revenues are shared to finance all redistribution in the two countries.

In this paper, I limit the analysis to a comparison of the two regimes in terms of their outcomes, especially their productive efficiency. Hence, I do not explicitly model many of the reasons why two countries might want to centralize their fiscal policies, like mutual insurance, economies of scale in the provision of public goods, etc. These aspects are well understood, and have recently been dealt with elsewhere (see e.g. Persson and Tabellini (1992), Alesina and Spolaore (1994), Alesina and Perotti (1994)).

3. The administration of fiscal policy. As discussed at length in the previous section, even when social security is funded with tax revenues collected at the central level, in general sub-central governments (and, *a fortiori*, countries within a federation) have considerable discretion in its administration, and therefore considerable leverage on the final expenditure. [9] To study the two macroeconomic questions posed at the beginning of Section 1 in a manageable way, I formalize this feature of social expenditure as follows. In country A the administration of the redistributive program is more generous, so that workers who apply can receive a pension s with probability $p > 0$. Only for simplicity, and without loss of generality, from now on I will assume that $p = 1$. By contrast, in B workers do not have access to the pension.

[9] For the purposes of this model, it is irrelevant whether it is the local government or the local branch of a federal agency that administer the program at the local level. Once again, the literature is fairly unanimous on this point: local governments should participate in the *administration* of redistributive programs *funded at the federal level*, particularly means-tested ones, because they possess informational and other administrative advantages over the central government (see for instance Ladd and Doolittle (1982) and ISSA (1987)). As a matter of fact, in the U.S. about 70% of expenditures connected to welfare programs is administered by local governments.

Thus, this formalization takes as given differences among sub-central governments in their position about social expenditure. The discussion of section 2 illustrates the main reasons for these differences, and undoubtedly there are more. However, because here I focus on the macroeconomic consequences of these differences, I do not model them explicitly.

4. Labor markets. In this model fiscal policy affects the equilibrium of the economy through its effects on labor supply and the allocation of capital (when capital is mobile). Fiscal policy has effects on the supply of labor because labor markets are unionized: in each country, all workers are organized in a monopoly union that takes the tax rate t and the subsidy s as given and sets the wage w (or equivalently, the level of employment L) to maximize the expected income of its members, subject to the labor demand function: [10]

$$\max \quad V = w\frac{L}{\bar{L}} + Ds\frac{(\bar{L} - L)}{\bar{L}} \tag{1}$$

s.t.

$$w = \alpha L^{\alpha-1}\bar{K}^{1-\alpha} \tag{2}$$

where D is a dummy variable denoting country A. [11] Thus, this expression reflects the fact that, due to the different stance of the fiscal authorities or administration, only in country A can a worker who decides not to work receive the subsidy s. Note that, implicitly, the utility of leisure has been normalized to 0 without loss of generality. The r.h.s. of (1) represents the expected income of a worker: with probability $L/\bar{L}$ he will be employed and will receive the wage w, while with probability $(\bar{L} - L)/L$ he will be unemployed and will receive an income s if he is in country A.

Thus, when a subsidy is available to unemployed workers, the reservation wage for union members increases and this is reflected in a higher wage demanded by the union and lower employment. Note that the presence of monopoly power in labor markets is essential: if the *individual* labor supply were elastic but the labor market were competitive, fiscal policy still would have no distortionary effects in this model. The reason, as it will become clear later, is that in competitive labor markets individuals would have no

[10] In equation (2) below, the capital stock that appears in the labor demand function is equal to the endowment of capital $\bar{K}$; thus, this expression assumes that capital is immobile. In section 4, the problem of the union will be modified to take into account capital mobility.

[11] In solving the model, I impose the restriction that s must be strictly less than the wage (it is clear that s cannot be higher than the wage, because nobody would want to work at a wage lower than the unemployment subsidy). Because this assumption implies that full employment always prevails in country B, it helps simplify the exposition considerably but in no way does it reduce the generality of the analysis. Indeed, it is possible to prove all the results of this model when s is not restricted to be less than the wage, at the cost of a significant lengthening of the analysis and without any gain in terms of intuition. Furthermore, this assumption is no longer required when capital is mobile, since in this case the wage is always strictly higher than s in both countries.

incentive to create unemployment by voting for a positive tax rate and therefore a positive subsidization of unemployment. By contrast, a union with some monopoly power can exploit redistributive fiscal policy as a leverage in setting the wage. Assumption 3, the difference in the administrative standards of redistributive policy, then means that in country A the union has access to an alternative income for unemployed workers, and therefore might use it as a leverage to create and finance unemployment.

B. Discussion of the assumptions.

Before turning to the solution of the model, four assumptions deserve some discussion. First, the program is financed by a proportional tax on capital income. This makes the analysis easier and the exposition more intuitive. However, one could relax this restriction and allow for taxation of labor income in at least two ways. One could assume that the distribution of labor endowments among workers has some dispersion. If the distribution of endowments is sufficiently skewed to the right (the empirically relevant case), a majority of workers could still vote for a positive tax rate even if it falls on labor too. Alternatively, one could assume, realistically, that the tax rate is progressive. [12] Although conceptually both extensions would be rather straightforward, they would make the solution of the model much more cumbersome, without adding any substantial insight to the main argument.

Second, the wage is set by a monopoly union. An alternative way to depart from the assumption of perfectly competitive labor markets is that the wage (and perhaps employment) is set by bargaining. As it is well known the outcome of bargaining is efficient, while this is not the case with a monopoly union. Bargaining too could be easily incorporated into the model, but again nothing would change in the basic message of the paper. With a monopoly union, redistribution increases the alternative income for unemployed workers. With bargaining, redistribution would increase the threat point of the union; in both cases, the result is a higher wage. In fact, the source of the result of the present model is not that the union chooses an inefficient outcome given the tax rate t, rather, that voters choose a too high t given the outcome of the wage negotiations.

Third, labor is immobile. Again, this assumption is made only for simplicity: in fact, in this model labor mobility would not make any difference. By definition, a monopoly union can set the wage and therefore employment in its country; thus, any worker who wanted to move from the other country would not be able to be employed, and at most

[12] In this case the degree of progressivity would have to be determined outside the model, since, as it is well known, it is difficult to establish the existence of a non-cycling majority when the tax rate is not proportional.

he would be able to collect a pension; but since in equilibrium the pension is always less than the full employment wage, no worker will ever want to do that. [13]

Finally, there is only one fiscal program. Alternatively, one could assume that fiscal revenues can be used to finance a second program, like an unemployment benefit. The only complication is that one must also provide a mechanism that governs the allocation of revenues between the two programs. An example of one such mechanism is bargaining between the clienteles of the two programs. Provided that country A has looser standards in administering the unemployment benefit too, the logic of the model would still go through: indeed, it would still be true that A's monopoly union has more leverage when setting the wage than B's union.

4 Fiscal policy with immobile capital.

A. Unemployment in the two regimes.

Because it is the most intuitive case, I first analyze the two regimes when capital is immobile between the two countries. Clearly, in country B the best a union can do is to employ all its members by setting the wage at its full employment level. In country A, at an internal solution the optimal wage is a mark-up over the alternative cost of employment to the union, s:

$$w = \frac{s\,\sigma}{\sigma - 1} = \frac{s}{\alpha} \tag{3}$$

where σ is the (negative of the) elasticity of the demand for labor to the wage, which from (2) is equal to $\frac{1}{1-\alpha}$. However, if the wage at full employment is already higher than the r.h.s. of (3), the union will set the wage at its full employment level. Combining these results, one obtains that employment in country A is defined by:

$$\begin{cases} w(L) = s/\alpha & \text{for} \quad s/\alpha > w(\bar{L}) \\ L = \bar{L} & \text{for} \quad s/\alpha \leq w(\bar{L}) \end{cases} \tag{4}$$

where $w(L) = \alpha L^{\alpha-1}\bar{K}^{1-\alpha}$. Thus, (4) defines employment as a negative function of the subsidy s. Hence, the larger the revenues available for redistribution, the higher s and the higher unemployment. In the centralized regime, country A can subsidize unemployment using some fiscal revenues from country B, where there is no unemployment to subsidize. This provides the basic intuition for the following

[13] See Epple and Romer (1991) and Wildasin (1991) for analyses of the interaction of labor mobility with redistributive fiscal policy at the subnational level.

Proposition 1:
When capital is immobile across countries, there is unemployment in country A in both regimes, and higher in the centralized regime.
Proof:
See Appendix A.

B. Intuition.

Decentralized regime.
The government budget constraint implies the following relationship between s and t in a decentralized regime:

$$s(t,L) = \frac{(t-t^2)(1-\alpha)L^{\alpha}\bar{K}^{1-\alpha}}{\bar{L}_R + \bar{L} - L} \qquad L \leq \bar{L} \tag{5}$$

To understand this expression, note that $(1-\alpha)L^{\alpha}K^{1-\alpha}$ is total income from capital. The numerator on the r.h.s. of (5) therefore represents total tax revenues, while the denominator is the mass of agents who receive the subsidy s, i.e. the $\bar{L}_R$ retirees plus the $\bar{L} - L$ unemployed workers. Together, (4) and (5) determine s and L as functions of t. The important point about these two functions is that both are monotonic, the first positive and the second negative. In fact, s is an increasing function of t for $s \in [0, \frac{1}{2})$, and is maximized at $t = \frac{1}{2}$. It is then intuitive that as t and therefore s increase, the optimal wage set by the union increases too, since as shown above it is just a mark-up $1/\alpha$ over the subsidy. As the wage increases, employment decreases. [14]

Because full employment always prevails in country B, all one has to do in order to determine the equilibrium employment and production in this two-country world is to find the tax rate and therefore the level of employment that prevail by majority voting in country A.

Consider then how the various agents in country A will vote. It is clear that capitalists always vote for $t = 0$, since the burden of the tax falls entirely on capital. As to retirees, they vote for the tax rate that maximizes the pension, i.e. for $t = 1/2$. The tax rate proposed by workers will then be the winning proposal. Because the utility of workers depends on the tax rate only indirectly, one can think of them as voting on employment,

[14]This effect operates only after a certain tax rate $\bar{t}$. As long as the tax rate is below $\bar{t}$, s/α is smaller than the full employment wage $w(\bar{L})$, and the union has no interest in decreasing employment. Once t exceeds $\bar{t}$, however, s/α increases with t above the full employment wage and employment starts declining as the wage set by the union increases. Thus, dL/dt is 0 for $t \in [0, \bar{t}]$, it is negative for $t \in (\bar{t}, 1/2)$, and it is 0 at $t = 1/2$.

L, rather than the tax rate, t. In fact, the two problems are the same because there is a monotonic relation between the two variables for $t \in [\bar{t}, 1/2]$. Consider then the utility of workers at an interior optimum for the union, i.e. where $w = s/\alpha$, or equivalently for $t \geq \bar{t}$. Appendix A shows that the objective function of workers is maximized at the lowest possible L, or equivalently at the highest possible tax rate, $t = 1/2$.

As the workers' proposal coincides with that of retirees, this is the tax rate that prevails in equilibrium. The corresponding unemployment is the maximum unemployment that can be financed in country A, given that the tax base is that country's capital income. In country B, workers are indifferent to any tax rate, since capital is immobile and the subsidy cannot exceed the full employment wage. Holders of capital vote for $t = 0$, while retirees vote for the tax rate that maximizes the pension, $t = 1/2$. Because $\bar{L}_R > \bar{L}_K$, $t = 1/2$ prevails in equilibrium in country B. However, note that here the tax rate has no distortionary consequences because of the absence of unions and the assumption of capital immobility.

Thus, in both countries a majority of agents vote for the highest possible tax rate, and this generates a positive unemployment in country A.

Centralized regime.

The crucial difference between the two regimes is in the expressions for their budget constraints. In the centralized regime, the relationship between s and t is given by:

$$s(t, L) = \frac{(t - t^2)(1 - \alpha)(L^\alpha + \bar{L}^\alpha)\bar{K}^{1-\alpha}}{2\bar{L}_R + \bar{L} - L} \qquad L \leq \bar{L} \tag{6}$$

The important point is that (6) is not just a blown-up version of (5). Now for any given t the tax base and total tax revenues are, roughly speaking, double those of country A alone; however, these revenues must be divided among *less* than double the mass of individuals, since unnmployed workers in country B do not have access to the pension. Thus, for any given tax rate t more revenues are available to A's union to finance unemployment. As before, full employment always prevails in country B and in country A the union still sets the wage exactly as in (4). Thus, it is clear that capitalists in both countries vote for $t = 0$. Retirees in both countries vote for $t = 1/2$, the tax rate that maximizes the pension. Because workers in country B are indifferent to any tax rate, workers in A are again the decisive agents.

Again it is useful to cast the problem of workers in A as one of choosing the optimal employment. Appendix A shows that, as in the decentralized regime, the utility of workers is maximized at the smallest possible employment that can be financed by the existing tax base. Given the inverse relation between L and t, this means that workers in A will vote for $t = 1/2$, and this is the tax rate that will be adopted in equilibrium.

Although the equilibrium tax rates in the two regimes are the same, the corresponding levels of output and employment are different. The reason is that a centralized fiscal policy enables the union in A to use some of the tax revenues collected in B (in excess of those needed to subsidize B's $\bar{L}_R$ retirees) to subsidize more unemployment than it is possible to finance in the decentralized regime. [15]

C. Discussion.

Proposition 1 essentially states that, when policies are endogenous, centralized redistribution is productive inefficient relative to decentralized redistribution. This conclusion is similar to that of the public good approach to income redistribution, in the sense that in both cases a centralized system delivers higher taxation and redistribution. The underlying mechanisms and implications, however, are very different. There, a centralized system leads to more taxation and redistribution by solving the free-rider problem in the provision of the public good "welfare of the poor". Here, a centralized system allows a group of individuals in one country to exploit some available rents by "free-riding" on the fiscal resources of the other country. The asymmetry in the administration of the fiscal systems is at the heart of this result. In fact, if countries A and B were exactly symmetrical, i.e. if workers in country B had access to the subsidy or workers in country A did not have access to the subsidy, then in this model the centralized and the decentralized regimes would deliver exactly the same tax rates and redistribution in equilibrium. By contrast, in the public finance approach a centralized regime would give higher taxation regardless of any difference between the two countries.

It is important to emphasize that the notion of efficiency employed here is one of *productive* efficiency, and it refers exclusively to the allocation of resources in the economy. In fact, the equilibrium of the economy is always *Pareto* efficient, since it is a voting equilibrium and therefore corresponds to the preferred outcome of at least one group of voters.

5 Fiscal policy with mobile capital.

A. Unemployment in the two regimes.

[15] Consider again the analogy between the union and a monopolist "selling" the output L facing a constant marginal (opportunity) cost, s, and a constant elasticity of demand, $1/\alpha$. Clearly, this monopolist will react to this increase in the marginal cost by reducing the supply of labor.

One might object that the result of the previous section is highly dependent on the assumption of immobile capital. If the problem is that the union in country A uses fiscal resources to finance unemployment, will capital mobility not take care of it by raising the elasticity of the demand for labor in country A, thus limiting the ability of the union to exploit its monopoly power? In fact, a fairly general intuition suggests that capital mobility has a powerful effect in limiting the size of rents, and therefore the incentives to appropriate them. This and the next section show that in this model the answer may be surprisingly different from this first intuition. In particular, this section shows that this is the case only in a decentralized regime, while in a centralized regime unemployment might indeed be higher when capital is mobile. Thus, under capital mobility there might be even stronger efficiency reasons for decentralizing the financing of redistribution.

When capital is mobile, the after-tax marginal returns to capital in the two countries must be equalized: [16]

$$(1-t)L^{\alpha}K^{-\alpha} = (1-t_B)\bar{L}^{\alpha}(2\bar{K}-K)^{-\alpha} \tag{7}$$

There are two effects of an increase in taxation in A on the flow of capital from A to B: (i) the *direct effect* (i.e., at constant employment): when the tax rate in A increases relative to the tax rate in B, capital flows from A to B to reestablish equality of the after-tax marginal returns to capital; (ii) the *indirect effect*: the higher tax revenues that are available to subsidize unemployment induce a decline in employment and an outflow of capital from A. Because by definition the tax rates in the two countries are the same in the centralized regime, the direct effect operates only in the decentralized regime, while the indirect effect operates in both regimes. This implies that the elasticity of capital outflows to the tax rate is higher in a decentralized regime. Thus, the markup is now always lower than $1/\alpha$, although higher in the centralized regime. This provides the intuition for the next proposition:

Proposition 2:
When capital is mobile across countries:
(i) full employment always prevails in both countries in a decentralized regime;
(ii) there is positive unemployment in A in a centralized regime.
Proof:
See Appendix B.

[16]The subscript "B" denotes country B, while as usual all variables without a subscript refer to country A. Note that $L_B = \bar{L}$ always and $K_B = 2\bar{K} - K$.

B. Intuition.

Decentralized regime.

In the voting equilibrium, each voter in each country proposes the tax rate that maximizes his utility taking as given the tax rate in the other country. Thus, the voting outcome is a Nash equilibrium between the decisive voters in the two countries.

The equilibrium in country B is easily determined, as both capitalists and workers vote for $t_B = 0$. Indeed, $t_B = 0$ is a dominant strategy for workers for any given tax rate in A because it maximizes the outflow of capital from A to B and therefore the wage in B. Thus, $t_B = 0$ is the equilibrium tax rate in country B.

In country A, as usual capitalists vote for $t = 0$ and retirees vote for the tax rate that maximizes the pension, $t = 1/2$. Once again workers are the decisive voters. As in the case of immobile capital, it is useful to cast the workers' problem in terms of voting on employment rather than the tax rate. Now the marginal cost of *decreasing* employment is higher than when capital is immobile, because the required increase in the tax rate causes an outflows of capital for two distinct reasons: the higher tax rate on capital income (the direct effect of taxation) and the reduction in employment itself (the indirect effect of taxation). In fact, these two effects combined are so strong that the marginal cost of reducing employment is always higher than its marginal benefit at any value of L. Consequently, workers in A vote for full employment, or equivalently for $t = 0$. Because this is the tax rate that capitalists too prefer, $t = 0$ and full employment are the equilibrium outcomes in A as well.

Centralized regime.

Since only the indirect effects of taxation is present, A's workers now face a lower marginal cost of *decreasing* employment than in a decentralized regime. One would then expect that A's workers will vote for a higher unemployment in a centralized regime. In fact, A's workers vote for the highest possible unemployment, which is obtained at $t = 1/2$. As retirees also vote for $t = 1/2$ in order to maximize redistribution, this is the tax rate that will be adopted in the voting equilibrium. Note that, interestingly, B's workers too vote for $t = 1/2$. The reason is that, by maximizing the tax rate and therefore redistribution, B's workers can maximize unemployment in A and therefore the outflow of capital to B. Because the tax rate resulting from the voting process is now positive, unemployment in A will be positive too (and actually, the highest possible). As in the case of immobile capital, then, unemployment is higher in the centralized regime.

C. Unemployment with mobile and immobile capital.

The result in Proposition 2 - and its underlying logic - is well known from the literature on fiscal federalism: when the tax base is mobile, taxation is lower in a decentralized regime. When the distortionary effects of taxation are taken into account, like in this model, one might be tempted to use the logic that leads to Proposition 2 to infer a second result, namely that capital mobility also reduces unemployment in a centralized regime, relative to the case of immobile capital. This argument can be wrong, as shown in the next proposition:

Proposition 3:
(i) unemployment in the centralized regime can be higher when capital is mobile than when capital is immobile;
(ii) the difference in the unemployment rates between the two regimes can be higher when capital is mobile.
Proof:
See Appendix C.

D. Intuition.

The intuition for this result is straightforward. As the previous subsection has shown, the marginal cost of unemployment to A's workers is always lower than the marginal benefit in a centralized regime with capital mobility. Hence, A's workers will still try to generate as much unemployment as possible by voting for the highest possible tax rate. But when capital is mobile, for any given tax rate and employment in A total tax revenues are higher than when capital is immobile because the allocation of capital is more efficient. Intuitively, this means that when capital is mobile the tax base is higher, and therefore that more unemployment can be subsidized. [17] Note also that not only unemployment, but even output can be lower in the centralized regime when capital is mobile. This of course is important since the correct measure of aggregate productive efficiency in this model is total output, not employment.

[17]The formal argument is more complex than this. It is true that, for any given unemployment, the tax base and therefore the subsidy s are higher when capital is mobile; however, the mark-up of the wage on s is lower because the demand for labor is more elastic. In addition, the wage itself is lower because of the outflow of capital. As Appendix C shows, the net result of these three effects is that in general the wage is below the mark-up times the subsidy when all are evaluated at the equilibrium employment under immobile capital. Thus, to reestablish equilibrium employment must decrease relative to the case of immobile capital.

E. Discussion.

This section delivers two main messages. The first is relatively unsurprising, and follows almost immediately from the logic of the tax competition argument emphasized by the public good approach to redistribution: capital mobility reduces distortions in a decentralized regime. The second message is less obvious: capital mobility *per se* need not alleviate the distortions associated with centralized redistribution; in fact, in general it will exacerbate them.

Table 2 summarizes the main results of the paper so far. Each entry represents equilibrium unemployment: of course, the numbers in each entry are only meant to illustrate the ranking of the various cases. [18]

Table 2: **Unemployment and fiscal regimes.**

	Decentralized	Centralized
Immobile cap.	1	2
Mobile cap.	0	3

At the heart of these results is the notion that capital mobility makes an economy intrinsically more efficient. Capital mobility is usually assumed to reduce the monopoly power of a labor union by increasing the elasticity of the demand for labor it faces, thus inducing it to provide more employment. This effect is at work in this model. However, a second effect is also at work. Because the economy is more efficient when capital is mobile, for any given t and L tax revenues are higher; therefore, the marginal (opportunity) cost of employment to the union - the subsidy s - is higher, inducing the union to provide *less* employment. When the endogeneity of the tax rate is taken into account, the second effect prevails.

Notice that all one needs for the standard tax competition argument is the mobility of the tax base: for this, an economy with even one factor will do. To obtain the result of Proposition 3, one needs a richer model of the economy, where two factors can be combined more or less efficiently, in addition to the standard distortionary effects of

[18] The exception is the case of decentralized fiscal policy with capital mobility, where unemployment is actually 0.

taxation on aggregate labor supply.

6 Endogenous fiscal regimes.

A. Voting on the fiscal regime.

Propositions 2 and 3 would still be of limited significance if the political process took care of the inefficiency of the centralized regime. After all, not only is a centralized regime always more inefficient than the decentralized regime: it also entails a net flow of resources from country B to country A. It is then difficult to see why country B should participate in a centralized system of redistribution. Hence, once the choice of the regime too is endogenized, a decentralized regime should prevail; in the more relevant case of capital mobility, this would indeed take away all monopoly power from the union and both economies would be undistorted.

As it turns out, this intuition is wrong. Suppose that a centralized regime requires the approval of a majority of agents in each country to be implemented: that is, a country can opt out of the arrangement if a majority of its residents are against it, in which case fiscal policies in both countries will be decentralized. The following proposition summarizes the outcomes of this voting process:

Proposition 4:
Suppose that all agents in both countries vote over the choice of the fiscal regime, and that a centralized regime requires a majority of votes in each country. Then:
(i) when capital is mobile, centralized redistribution is adopted;
(ii) when capital is immobile, decentralized redistribution is adopted.
Proof:
The proof is immediate by comparing the utilities of each type of agent and in the two countries in the two regimes. Sub-section B below provides such a comparison in the context of a more intuitive proof of the proposition.

Thus, voters in *both* countries prefer the centralized regime *exactly when it is most inefficient*, i.e. when capital is mobile.

B. Intuition.

Clearly, in country A workers and retirees are better off in a centralized regime. In fact, workers could always reproduce the outcome of the decentralized regime by

voting for $t = 0$. If they choose not to do so, it must be the case that they are better off in the equilibrium of the centralized regime. Retirees are also better off in the centralized regime, because they get a positive pension as opposed to no pension at all in the decentralized regime. Hence, a majority of agents in country A will vote for a centralized regime.

Workers in country B also prefer the centralized regime, since B's capital stock is higher and so is their wage. Retirees too vote for the centralized regime for exactly the same reasons why A's retirees vote for it. Hence, in both countries a majority coalition of workers and retirees votes for centralized redistribution, at the expense of a minority of capitalists.

By contrast, when capital is immobile centralized redistribution would not gather enough consensus in country B. The reason is that now B's retirees are better off in a decentralized regime because they do not have to share their country's tax revenues with A's workers and retirees.

C. Discussion.

Proposition 3 and 4 together imply that, contrary to intuition, capital mobility will not take care of the inefficiencies associated with redistribution, quite the contrary. Not only does capital mobility exacerbate the relative (to the decentralized regime) and absolute inefficiency of the centralized regime (Proposition 3), but also it causes a shift in the preferences of the decisive agents and induces a majority of voters in *both* countries to vote for the more inefficient regime (Proposition 4.)

The crucial intuition behind this proposition is that capital mobility, while (indeed, exactly because) it hurts workers in country A, benefits workers and retirees in country B, by inducing a flow of capital to country B.

Thus, the four propositions of the paper provide a clear answer to the two questions that motivated the analysis: when countries (or regions within a country) differ substantially in their attitudes towards redistribution, for political or administrative reasons, then: (*i*) a system of centralized redistribution leads to a more inefficient allocation of resources; (*ii*) when both fiscal *policies* and fiscal *regimes* are allowed to be endogenous, capital mobility will not mitigate the problem inherent in centralized redistribution, rather, it will exacerbate it.

7 Extensions and conclusions.

The paper has focused on the consequences of an important type of institutional difference between countries joining a union or between regions within a country, namely, administrative standards and more generally collective attitudes towards social security programs. However, the basic framework can be extended to other, equally relevant institutional differences.

Suppose that the two countries differ in the structure of their labor markets: in the first country, the labor market is unionized, while in the second it is perfectly competitive. Hence, in the second country full employment always prevails, while in the first the union can use the fiscal system as a leverage, according to the usual mechanism. It is clear that from now on the analysis is formally identical to that of the present model, and all the results proved in this paper hold within this framework too. Differences in the degree of unionization of labor markets and in the power of labor unions do appear to be empirically important: among others, Calmfors and Drifill (1988) document important differences along this dimension among 17 OECD countries.

Similarly, the model of this paper could be easily extended to incorporate differences in tax, as opposed to expenditure, administration. Suppose in the first country taxes are evaded much more easily than in the second; then the marginal cost of redistribution in a centralized regime is lower in the first country, since it is mainly financed by tax revenues from the second country. Hence, the centralized regime allows one country to "free-ride" on the tax revenues of the other country, and again the same basic model developed in this paper can be used to study this case. Alesina and Mare (1994) show that there is extensive variation in the degree of tax evasion among European countries.

In all these cases, a major message of this paper is that a process of fiscal integration may lead to "bad" outcomes when it involves countries with very different institutional characteristics. Recently, other papers have focused the attention on several neglected advantages of decentralization in fiscal policy. Interestingly, these new arguments in favor of decentralization invest all three classical branches of fiscal policy: redistribution, provision of public goods, and stabilization policy.

Regarding redistribution, Alesina and Perotti (1994) address the issue of the insurance properties of a centralized fiscal regime. A longstanding argument in favor of fiscal centralization is that a centralized system that redistributes income *among* individuals automatically insures countries (or regions) against country- or region-specific shocks, because it indirectly redistributes income from the country hit by a positive shock to the country hit by a negative shock. Persson and Tabellini (1992) compare the properties of this system to those of a direct system of transfers among countries, and Sachs

and Sala-I-Martin (1992) show that this mechanism might be potentially relevant in the United States. Alesina and Perotti (1994) show that, when countries are characterized by highly polarized income distributions and the tax rate are determined endogenously by majority voting, a centralized regime, while reducing the variability of the tax *bases*, might increase the variability of the tax *rate*. Consequently, disposable incomes might become more, rather then less, variable, and welfare might fall for a majority of agents in all countries involved. The basic intuition is that in a centralized regime individuals from more countries, and therefore with more diverse preferences, participate in the decision over the tax rate.

A second longstanding argument in favor of centralization is that it helps overcome problems of economies of scale in the provision of public goods. Yet, when countries have different preferences about the types of public goods, these economies of scale must be weighed against a loss of specificity in the provision of the public good. Alesina and Spolaore (1994) study this trade-off between economies of scale and specificity and show that, when differences in preferences among countries are sufficiently strong, there will be more countries than it is socially optimal.

Finally, Gramlich (1987) has questioned the commonly held view that stabilization policies should be the exclusive domain of central governments, on the ground that central governments operate under flexible exchange rates and subnational governments under fixed exchange rates, and demand shocks can be inversely correlated across regions of a country.

All these arguments in favor of decentralization must be weighed against the merits of centralization advocated by a long tradition in public finance, which still retain all their validity. Ultimately, the choice between the two systems has to be made on empirical grounds. Hopefully, this paper has contributed to clarifying one aspect of the trade-off.

Appendix A.

This Appendix shows that when capital is immobile a positive unemployment is possible only if α is smaller than a certain value α_0.

At an internal optimum for the union, $w(L) = s(t, L)/\alpha$. Because w is a decreasing function of L, while s is an increasing function of both L and t for $t \in [0, 1/2)$, a necessary condition for an internal optimum is $s(1/2, \bar{L})/\alpha > w(\bar{L})$. Using the government budget constraint to express s as a function of t and L, this condition becomes:

$$\frac{1}{4}\frac{(1-\alpha)\bar{L}^{\alpha}\bar{K}^{1-\alpha}}{\alpha\bar{L}_R} > \alpha\bar{L}^{\alpha-1}\bar{K}^{1-\alpha} \tag{A.1}$$

This gives:

$$\alpha < \frac{-1+\sqrt{1+16l_R}}{8l_R} \equiv \alpha_0 \tag{A.2}$$

where $l_R \equiv \bar{L}_R/\bar{L}$. To gather some idea on the size of α_0, notice that α_0 tends to 1 as l_R tends to 0, it is exactly .5 when $l_R = .5$ and it is about .62 for $l_R = .25$.

It is also easy to show that the same condition on α is necessary for a positive level of unemployment to be possible in a centralized regime. A similar procedure can also be followed to show that $\alpha < \alpha_1$ is a necessary condition for unemployment to be possible when capital is mobile, where

$$\alpha_1 \equiv \frac{-(2l_R+1)+\sqrt{1+4l_R^2+12l_R}}{4l_R} < \alpha_0 \tag{A.3}$$

Appendix B.

This section proves the two parts of Proposition 2.

(i) In this part, I prove that when capital is mobile there is no unemployment in either country in a decentralized regime. Because the result is rather intuitive in the case of country B, I focus only on the determination of the equilibrium in country A.

Consider the problem of workers first. At an internal optimum for the union

$$w = \frac{L + \bar{L}\theta}{\alpha L + \bar{L}\theta} s \tag{B.1}$$

Using the government budget constraint

$$s = \frac{(t - t^2)(1 - \alpha)L^{\alpha}K^{1-\alpha}}{\bar{L}_R + \bar{L} - L} \tag{B.2}$$

and the arbitrage condition

$$\frac{K}{L} = \frac{2\bar{K}}{L + \bar{L}\theta} \tag{B.3}$$

(B.1) can be rewritten as:

$$H \equiv \alpha(\alpha L + \bar{L}\theta)(\bar{L}_R + \bar{L} - L) - (t - t^2)(1 - \alpha)L(L + \bar{L}\theta) = 0 \tag{B.4}$$

Equation (B.4) defines the implicit relation between L and t at an internal optimum for the union. Now consider the derivative of H with respect to L:

$$\frac{\partial H}{\partial L} = \alpha^2(\bar{L}_R + \bar{L} - L) - \alpha(\alpha L + \bar{L}\theta) - (t - t^2)(1 - \alpha)(2L + \bar{L}\theta) \tag{B.5}$$

Using (B.4), (B.5) can be shown to be always strictly negative $\forall t \in [0, \frac{1}{2}]$ and $\forall L \in [0, \bar{L}]$. Then, because both $\partial H/\partial L$ and $\partial H/\partial t$ are continuous, (B.4) defines a continuous function $L = \phi(t)$ whose derivatives too are continuous (see Figure 1).

The function ϕ describes the employment chosen by the union for any given tax rate t. The existence of this function implies that there is only one L corresponding to any given t, but so far there is no guarantee that there is only one t corresponding to any given L. However, it should be obvious that workers will never propose a tax rate t that induces the same level of employment L as a lower tax rate. Thus, all the tax rates in the intervals $(t_2, t_3]$ and $(t_4, t_5]$ in Figure 1 are clearly dominated by some lower tax rate. Moreover, it is straightforward to show that there are no flat segments in Figure 1, i.e. that the derivative of $\phi(t)$ is zero at most in isolated values of t. Effectively, then, (B.4) also defines t as a function of L, $t = \psi(L)$. Moreover, this function is monotonically

decreasing, although in general it is not continuous (see Figure 2). Note also that, because $\partial H/\partial L$ is never 0, dt/dL is always *strictly* negative.

The next step consists in showing that, whenever dt/dL is negative, the derivative of the workers' objective function with respect to L is positive. In fact, using (B.1) one can write this objective function as:

$$V = w\left[L + \frac{\alpha L + \bar{L}\theta}{L + \bar{L}\theta}(\bar{L} - L)\right] \tag{B.6}$$

Using (B.3) and the expression for the wage $w = \alpha L^{1-\alpha}K^{1-\alpha}$, one obtains

$$log\ V = (\alpha - 2)log\ (L + \bar{L}\theta) + log\ \left[(1-\alpha)L^2 + \bar{L}(\alpha L + \theta\bar{L})\right] \tag{B.7}$$

Differentiating with respect to $log\ L$, after some algebraic passages one obtains:

$$\begin{aligned}\frac{dlog\ V}{dlog\ L} &= -\frac{1}{PQ}\left\{\bar{L}\theta\beta\left[L^2(1-\alpha)(2-\alpha) - L\bar{L}(1-\alpha)^2 + \bar{L}^2\theta(1-\alpha)\right]\right\} \\ &\quad -\frac{1}{PQ}\left\{(1-\alpha)L(\bar{L}-L)\left[2\theta\bar{L} + \alpha L\right]\right\}\end{aligned} \tag{B.8}$$

where $P \equiv L + \theta\bar{L}$, $Q \equiv (1-\alpha)L^2 + \bar{L}(\alpha L + \theta\bar{L})$ and β is the elasticity of θ to L:

$$\beta \equiv \frac{dlog\ \theta}{dlog\ L} = \frac{dlog\ \theta}{dlog\ t}\frac{dlog\ t}{dlog\ L} = \frac{1}{\alpha}\frac{t}{1-t}\frac{dlog\ t}{dlog\ L} \tag{B.9}$$

$dlog\ t/dlog\ \theta$ can be determined by implicit differentiation of the condition for an optimum for the union (B.4):

$$\frac{dlog\ t}{dlog\ L} = -\frac{\alpha^2(\bar{L}_R + \bar{L} - L) - \alpha(\alpha L + \theta\bar{L}) - (t - t^2)(1-\alpha)(2L + \theta\bar{L})}{-(1-2t)(1-\alpha)L(L + \theta\bar{L}) + \bar{L}\left[\alpha(\bar{L}_R + \bar{L} - L) - (t - t^2)(1-\alpha)L\right]\frac{d\theta}{dt}}\frac{L}{t} \tag{B.10}$$

Because dt/dL is always negative, β is always negative too. Hence, since the numerator of (B.10) is always negative, the denominator must be negative as well. Using (B.4) it is easy to show that the numerator of (B.10) is larger, in absolute value, than $L\left[\alpha(\alpha L + \theta\bar{L}) + (t - t^2)(1-\alpha)L\right]$. As to the denominator, note that the term in brackets is always positive: in fact, using (B.4), one can rewrite this term as $(1-\alpha)^2L^2(t - t^2)/(\alpha L + \theta\bar{L})$. Therefore, in absolute value $dlog\ t/dlog\ L$ is larger than:

$$\text{abs}\left(\frac{dlog\ t}{dlog\ L}\right) \geq \frac{L\left[\alpha(\alpha L + \theta\bar{L}) + (t - t^2)(1-\alpha)L\right]}{t(1-2t)(1-\alpha)L(L + \theta\bar{L})} \tag{B.11}$$

and using the definition of β in (B.9) one can bound the absolute value of β from below:

$$\text{abs}(\beta) \geq \frac{\alpha(\alpha L + \theta\bar{L}) + (t - t^2)(1-\alpha)L}{\alpha(1-\alpha)(L + \theta\bar{L})} \tag{B.12}$$

But from (B.4) $(t - t^2)(1-\alpha)L = \left[\alpha(\alpha L + \theta\bar{L})(\bar{L}_R + \bar{L} - L)\right] / \left[L + \theta\bar{L}\right]$, so that

$$\text{abs}(\beta) \geq \tilde{\beta} \equiv \frac{\alpha L + \theta\bar{L})\bar{L}(1+\theta)}{(1-\alpha)(L + \theta\bar{L})^2} \tag{B.13}$$

and therefore

$$\begin{aligned} \frac{dlog\ V}{dlog\ L} \geq\ & \frac{1}{PQ}\left\{\frac{\bar{L}\theta(\alpha L + \theta\bar{L})\bar{L}(1+\theta)}{(L+\theta\bar{L})^2}\left[L^2(1-\alpha)(2-\alpha) - L\bar{L}(1-\alpha)^2 + \bar{L}^2\theta(1-\alpha)\right]\right\} \\ & -\frac{1}{PQ}\left\{(1-\alpha)L(\bar{L}-L)\left[2\theta\bar{L} + \alpha L\right]\right\} \end{aligned} \tag{B.14}$$

Now let M_0 be the term in braces in (B.14), multiplied by $(L + \theta\bar{L})^2$. Since $t_B = 0$, $\theta \geq 1$; hence, $(\alpha L + \theta\bar{L})(1+\theta) > \alpha L + 2\theta\bar{L}$ and

$$M_0 > M_1 \equiv \theta\bar{L}^2\left[L^2(2-\alpha) - L\bar{L}(1-\alpha) + \theta\bar{L}^2\right] - (1-\alpha)L(\bar{L}-L)(L+\theta\bar{L})^2 \tag{B.15}$$

It is easy to show that M_1 is a convex function of θ. Because its derivative, evaluated at $\theta = 1$ is positive, M_1 is a positive function of θ and therefore it is minimized at $\theta = 1$. Similarly, it is easy to show that, for any given θ, the derivative of M_1 with respect to α is also positive. Thus,

$$M_1 \geq M_2 \equiv \bar{L}^2\left[2L^2 - L\bar{L} + \bar{L}^2\right] - L(\bar{L}-L)(L+\bar{L})^2 \tag{B.16}$$

It is relatively straightforward to show that $M_2 \geq \bar{L}^2(\bar{L}-L)^2$, which is clearly always non-negative. Because $dlog\ V/dlog\ L > M_2$, this establishes that the objective function of workers is always increasing in L at internal optima for the union.

But then consider any $L \in [0, L_4]$ in Figure 2 that are internal optima for the union. As L increases in this interval the workers' objective function V increases. At L_4, the function $t = \psi(L)$ is discontinuous; however, it is clear that L_4 strictly dominates any other point in the interval $[0, L_4]$ because $t_4 < t_5$. Correspondingly, t_4 maximizes V in the interval $[t_4, \frac{1}{2}]$. Similarly, it is clear that L_1 and t_1 maximize V in the intervals $[0, L_1]$ and $[t_1, \frac{1}{2}]$ respectively. Proceeding this way, it is clear that workers will always vote for $t = 0$ or, equivalently, full employment.

As usual, capitalists also vote for $t = 0$, while retirees vote for the strictly positive tax rate that maximizes s. Thus, a majority composed of capitalists and workers vote

for $t = 0$, and as a result full employment always prevails in equilibrium in country A as well.

(ii) To prove that unemployment in A is positive in the centralized regime, note that the problem of A's workers in the centralized regime is the same as in the decentralized regime, except that now $\theta = 1$ identically and consequently $\beta = 0$ always. From (B.8), it follows that $dlog\ V/dlog\ L$ is always negative. In addition, from (B.10) $dlog\ L/dlog\ t$ is always negative too, so that the utility of A's workers is maximized when $t = 1/2$ and unemployment reaches he maximum. Because retirees in both countries also vote for $t = 1/2$, this is the tax rate that prevails in the voting process. As a result, the equilibrium unemployment in A is the highest that can be subsidized.

Appendix C.

This Appendix shows that unemployment in a centralized regime may be larger when capital is mobile than when capital is immobile.

Assume initially that at the tax rate $t = 1/2$ the subsidy s when capital is immobile is lower than the full employment wage. Then the equilibrium condition that determines employment when capital is immobile is:

$$4\alpha(2\bar{L}_R + \bar{L} - L) = L(1-\alpha)\left(1 + \frac{\bar{L}^\alpha}{L^\alpha}\right) \tag{C.1}$$

When capital is mobile, the same equilibrium condition has the form:

$$4\alpha(2\bar{L}_R + \bar{L} - L) = (1-\alpha)\frac{(L+\bar{L})^2}{(\alpha L + \bar{L})} \tag{C.2}$$

The l.h.s. is the same decreasing function of L in both (C.1) and (C.2). In both expressions, the r.h.s. is increasing in L, and moreover the r.h.s. of (C.2) can be easily shown to be always above the r.h.s. of (C.1). In fact, the former is strictly greater than $(1-\alpha)(L+\bar{L})$, which is not smaller than the latter for $L \in [0, \bar{L})$, Consequently, equilibrium employment is lower when capital is mobile (see Figure 3). Notice however that it does not necessarily follow that the combined production of the two countries is lower, because capital is utilized more efficiently when capital is mobile.

However, the discussion so far has assumed that the equilibrium subsidy common to both countries is below the full employment wage when capital is immobile. If this is not the case, the tax revenues collected in B in excess of those needed to pay the full employment wage to all retirees in B can be used to finance redistribution in A. In this case, the l.h.s. of the equilibrium condition (C.1) is smaller than that of (C.2) and employment may (but need not) be smaller when capital is immobile than when capital is mobile.

References.

Alesina, A. and M. Mare (1994): "Evasione fiscale in una cross-section di paesi", mimeo, Harvard University;
Alesina, A. and R. Perotti (1994): "Economic Risk and Political Risk in Fiscal Unions", mimeo, Harvard University;
Alesina, A. and E. Spolaore (1994): "On the Number and Size of Countries", mimeo, Harvard University;
Brown, C. and W. Oates (1987): "Assistance to the Poor in a Federal System", *Journal of Public Economics*,32, 307-330;
Calmfors, L. and J. Driffill (1988): "Bargaining Structure, Corporatism, and Macroeconomic Performance", *Economic Policy*, 13-62;
de Haan, J, C.G.M. Sterks and C.A. de Kam (1992): "Towards Budget Discipline: an Economic Assessment of the Possibilities for Reducing National Deficits in the Run-up to EMU", *Economic Papers*, Commission of European Communities, no. 99;
Derthick, M. (1990): *Agency Under Stress: The Social Security Administration in American Government*, The Brookings Institutions, Washington, D.C.;
Emerson, M. (1988): "What Model for Europe?", Cambridge, Ma, MIT Press;
Epple, D. and T. Romer (1991): "Mobility and Redistribution", *Journal of Political Economy*, 98, no. 4, 828-58;
Ferrero, M. (1984): "Il Welfare State in Italia", Il Mulino, Bologna;
Gramlich, E. M. (1987): "Subnational Fiscal Policy", in: Quigley, J. M.: *Perspectives on Local Public Finance and Public Policy*, JAI Press;
Inman, R. and D. Rubinfeld (1992): "Fiscal Federalism in Europe: Lessons from the United States Experience ", *European Economic Review*, 36, 654-660;
International Social Security Association (1987): "Administrative Decentralization of National Social Security Schemes", Geneva;
Johnson, W. (1988): "Income Redistribution in a Federal System", *American Economic Review*, June, 570-73;
Johnson, W. (1990): "Decentralized Income Redistribution Reconsidered", *Economic Inquiry* 29, 69-78;
Ladd, H.F. and F.C. Doolittle (1982): "Which Level of Government Should Assist the Poor?", *National Tax Journal* 35, 323-36;
Oates, W. (1972): *Fiscal Federalism*, New York, Harcourt Brace;
Orr, L.L. (1987): "Income Transfers as a Public Good: an Application to AFDC", *American Economic Review*, 66, 359-71;
Parsons, D. O. (1991): "Self-Screening in Targeted Public Transfer Programs", *Journal*

of Political Economy, 99, n0. 4, 859-76;
Pauli, M.V. (1973): "Income Redistribution as a Local Public Good", *Journal of Public Economics* 2, 35-58;
Persson, T. and G. Tabellini (1992): "Federal Fiscal Constitutions. Part 1: Risk Sharing and Moral Hazard", CEPR Working Paper No. 728, October;
Persson, T. and G. Tabellini (1994): "Does Centralization Increase the Size of Government?", forthcoming, *European Economic Review*;
Sala-I-Martin, X. and J. Sachs (1992): "Fiscal Federalism and Optimum Currency Areas: Evidence for Europe from the United States", in: M. Canzoneri, P. Masson and V. Grilli (eds.): *Establishing a Central Bank: Issues in Europe and Lessons from the U.S.*, London, Cambridge University Press;
Stigler, G. (1957): "Tenable Range of Functions of Local Government", in: Joint Economic Committee, Subcommittee on Fiscal Policy: *Federal Expenditure Policy for Economic Growth and Stability*, Washington, D.C.;
Yates, S. (1986): "Computerized synthesis of responses to questionnaire", *International Research Conference on Social Security Disability Programs*, Bureau of Economic Research, Rutgers Univerity;
Wildasin, D. E. (1991): "Income Redistribution in a Common Labor Market", *American Economic Review*, Vol. 81, no. 4, 757-774.

Fig. 1

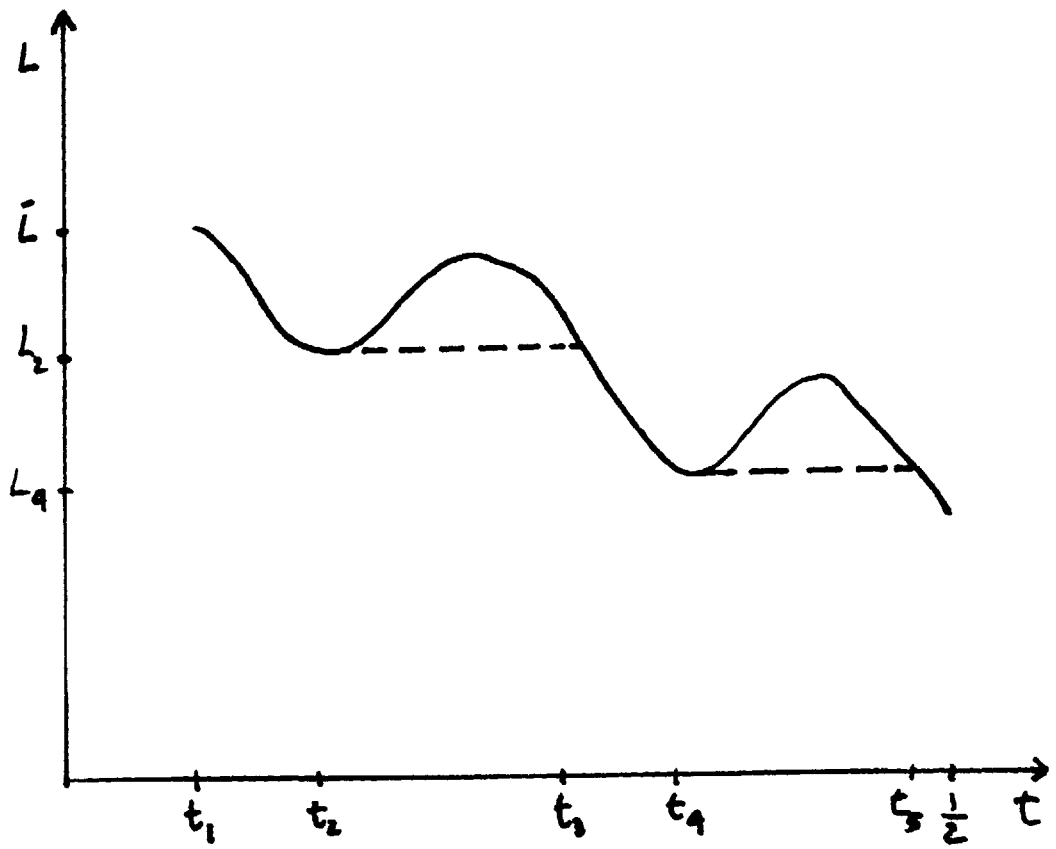


Fig. 2

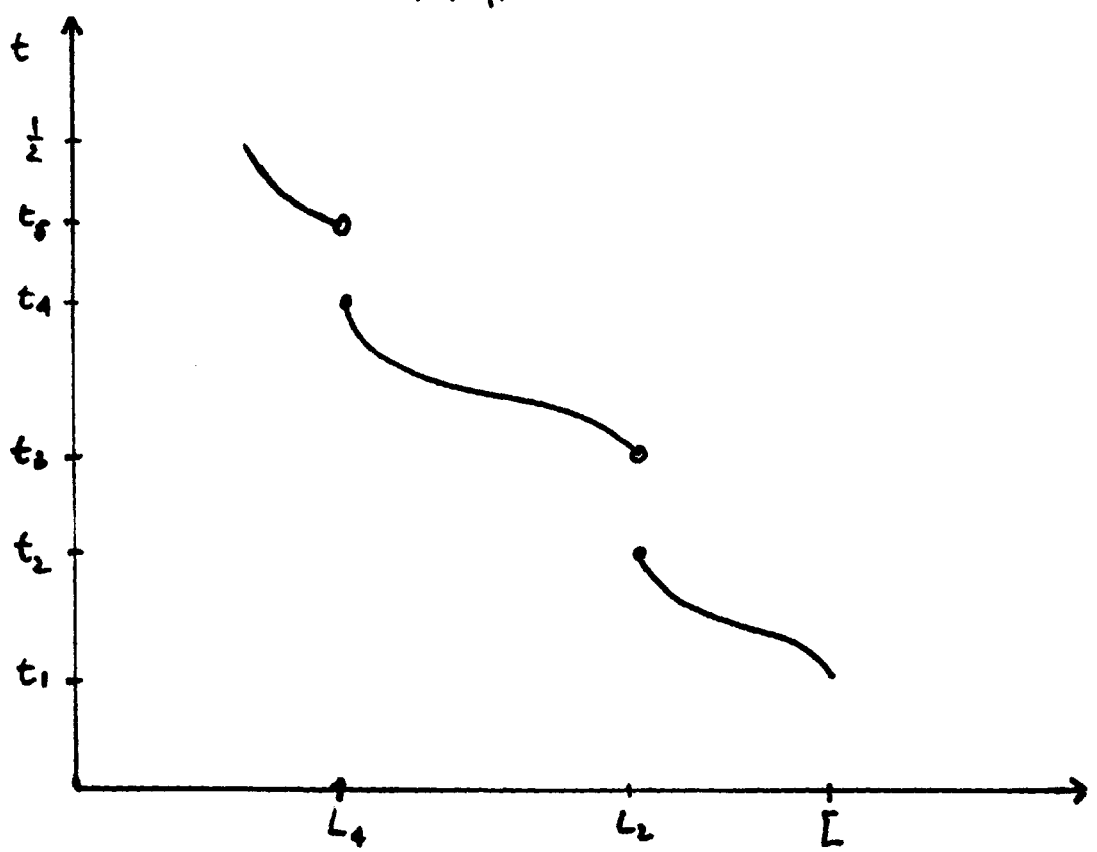
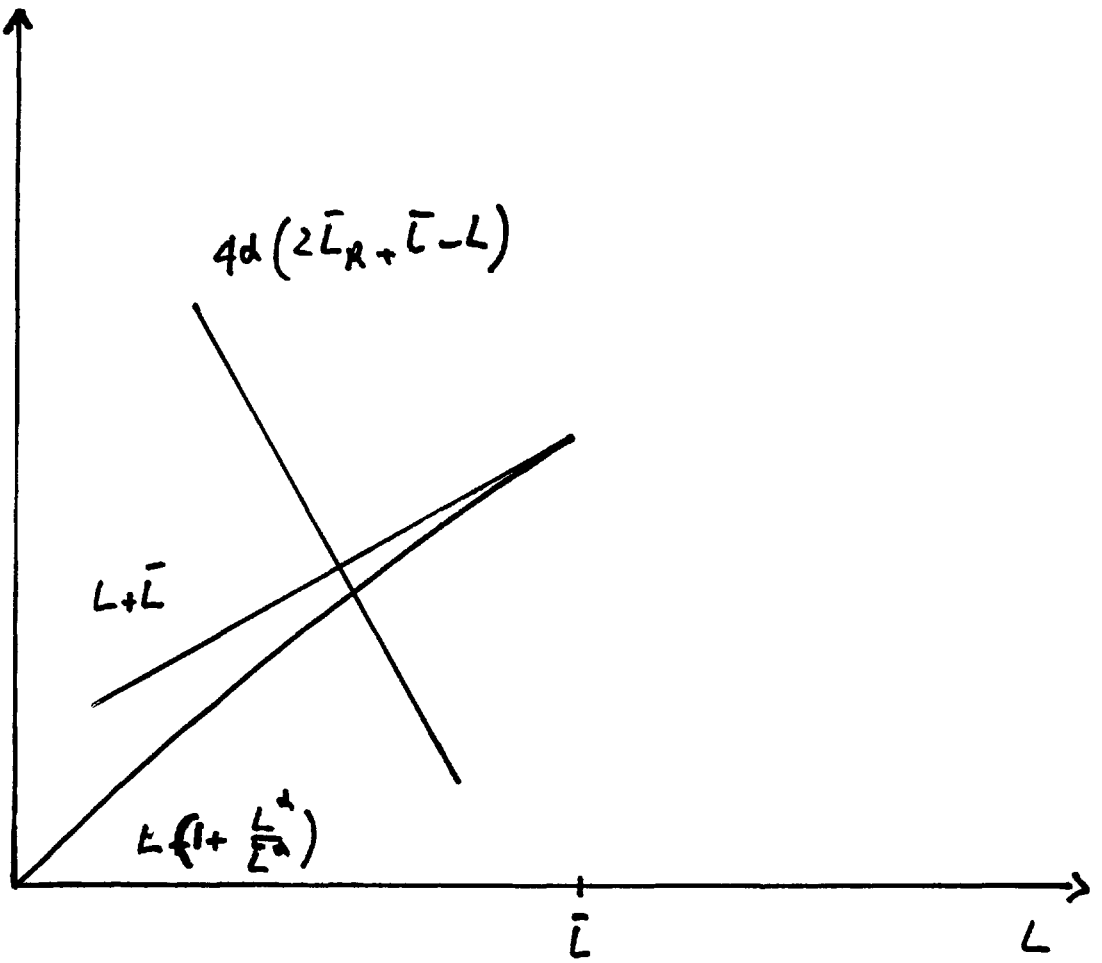


FIG. 3



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